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Optical Cable Closure Maintenance System

Technical Field

The present invention relates to an optical cable closure, or more particularly to the maintenance system capable of detecting inundation at said closure including a no-power electronic sensor without opening the same.

Background Art

Generally, the step of connecting the central office to the subscribers with optical cables requires many connection points. At these connection points, the connection materials for the optical cable, for example the optical cable closure or optical intermediate switch box or vacant terminal box, are installed to connect the optical cables to each other. The connection materials for the optical cable not only connect the optical cables snapped to each other, but also perform the task of avoiding a deterioration of the connection region due to the external environment.

The optical cable closure is commonly installed at a manhole etc. so that the connection region of the optical cable is protected from the external environment. However, it must have superior protection characteristics against the environment than other connection materials since the contaminated water is frequently full at the manhole etc. in contrast to the atmosphere, and the degree of air contamination existing at the manhole is more severe than that at the atmosphere. Particularly, the optical cable closure basically should have capability of sealing for cutting off permeation of contaminated water into the closure.

If the state of inundation at the closure with the exposure of the optical fiber to moisture is continued, the function of the optical fiber is lost. Fig. 1 is a graph indicating the process at the varying intensity of the optical fiber as a function of time. Fig.2a is a diagram showing the surface of the optical fiber in normal environment, Fig.2b is a diagram showing the surface of the optical fiber after being exposed to moisture for a long period time, and Fig.2c is a diagram indicating the surface of the optical fiber exposed to chemicals. As shown in the drawings, it was found that the optical fiber is negatively affected and damaged thereby when the optical fiber is exposed to moisture or chemicals.

As described above, the fact that the performance of the optical fiber is degraded can be found only after the predetermined time has passed with exposure to moisture. In other words, since the defect in the communication equipment can be discovered only after a long period of time in the state of inundation of the optical cable closure, the subscribers who benefited the communication equipment meanwhile must put up with the inconvenience of generation of error or interruption in communication.

On the other hand, the conventional closure for the optical cable is waterproof by resealing the exterior of the closure with a gel compound etc. under sealing or by using a material such as sealing tapes in order to prevent water from permeating into the closure. In this case, it is impossible to check as to whether the water has permeated into the closure when the phenomena of aging occurs due to the defective

work or closure or the long term use therof. Further, in addition to the fact that the waterproof material can not be recycled therein, the conventional closure entails inconvenience and economical loss since it involves reworking after dismantling in case of a problem within the box, with the result of much loss in human resources.

The object of the present invention, in resolving the aforementioned problems, is to provide a maintenance system capable of detecting inundation of the optical cable closure without opening the same.

The another object of the present invention is to provide an optical cable closure comprising a highly sensitive no-power electronic sensor.

The another object of the present invention is to provide a maintenance system capable of recording and storing the periodic measurement values of changes in humidity and temperature of the optical cable.

The another object of the present invention is to reduce the cost of human resources and the maintenance of the closure.

To achieve these goals, the present invention relates to an optical cable closure maintenance system comprising a closure including a sealed no-power electronic sensor, and a water sensing meter for detecting information about the temperature and humidity within the closure, provided through the no-power electronic sensor, wherein the inundation therein can be detected without opening the closure.

The detailed feature of the present invention is that said water sensing meter comprises an A/D converter converting a sensor analog signal of the humidity and

temperature within the closure detected by the no-power electronic sensor into a digital signal, a key entry part inputting a control signal and set data and the like according to a mode selection key, an up/down key and other respective functions, handled selectively by an user, a micom performing a general control function a set program, receiving inputs signals outputted from the respective portion, a liquid crystal display displaying the result of humidity detection, temperature detection and respective parameters at the closure provided by said A/D converter with numerals and letters, an alarm generator generating a failure alarm according to the control signal of the micom, a memory device for storing information provided by said A/D converter and an output signal of said micom, and an interface for outputting the information of said memory device to an external device.

The another detailed feature of the present invention is that said micom comprises a set memory having an allowable threshold valve information in the ratio of temperature to humidity at the closure.

Brief Description of the Drawing

Fig. 1 is a graph indicating the process at the varying intensity of the optical fiber as a function of time.

Fig.2a is a diagram indicating the surface of the optical fiber in the normal environment.

Fig.2b is a diagram indicating the surface of the optical fiber after being exposed to moisture for a long period of time.

Fig.2c is a diagram indicating the surface of the optical fiber exposed to chemicals.

Fig.3 is a block diagram indicating the maintenance system according to the present invention.

Fig.4 is a diagram indicating the water sensing meter of the Fig.3.

Detailed Description of the Preferred Embodiment

The constitution and operation features of the present invention are described in detail with accompanying drawings as follows. Fig.3 is a block diagram indicating the maintenance system according to the present invention. The invention comprises a closure (10) including a sealed no-power electronic sensor (11), and a water sensing meter (20) for detecting information about temperature and humidity within the closure, provided by said no-power electronic sensor (11). The water sensing meter (20) comprises an A/D converter (21) converting an analog signal detected by the no-power electronic sensor (11) at the closure (10) into a digital signal, a key entry part (22) inputting a control signal of user, a micom (23) performing a general control function by a set program inputted by each output signals, a liquid crystal display (hereinafter LCD) (25) displaying information of detection results and respective parameter, provided by said A/D converter (21), an alarm generator (24) generating a warning alarm according to the control signal of said micom (23), a memory device (27) for storing information provided by said A/D converter (21) and an output signal of said micom (23), and an interface (26) for outputting the information of said memory

device (27) to the external device.

The closure (10) is basically sealed not to be inundated, however it is assumed that said box could be inundated since the point of the present invention is that the device can detect inundation which could occur as the time of sealing goes by. A highly sensitive no-power electronic sensor (11) is included in the form of a module within the closure (10) in order to detect temperature and humidity therein. The information detected by said no-power electronic sensor (11) is outputted in such manner of a serial port as RS232C, etc. The detection result of temperature and humidity in an analog style outputted by said no-power electronic sensor (11) is converted into the digital value through the A/D converter (21).

The converted sensor information of the temperature and humidity is delivered to a micom (23) by the buffer (not shown). The user can set an allowable temperature range of the temperature spec included at the water sensing meter (20), and the detection temperature within the allowable temperature in which the range is -30℃ ~100℃ is indicated at the LCD (25) with a digital unit of 1℃. Similarly, the humidity detected by the humidity spec therein is also indicated in the unit of 1%. The allowable threshold value information of the ratio of the temperature to the humidity is stored at the predetermined memory at the micom (23). Using this information, the micom (23) can recognize water permeation and surplus humidity within the closure through the detected information of the temperature and humidity.

Fig.4 is a diagram indicating the water sensing meter (20) according to the

present invention. The water sensing meter (20) comprises a power switch (31) for switching the power supply of the water sensing meter, a mode selection switch (32) for selecting the sensing mode of the user, an up/down control key (33), a reset switch (36) for resetting the setting condition, a luminescence (35) for indicating a normal or fault condition, a LCD (34) displaying the operation condition and measurement results of the water sensing meter (20) with numerals and letters, a PS/2 port (38) receiving a sensor information of temperature and humidity from the electronic sensor (11) at the closure (10), and a printing switch (37) for outputting the detection results of the water sensing meter (20) via the interface (26) included through the serial port.

The description of the main operation procedure of said water sensing meter (20) is as follows. When the power of the water sensing meter (20) is turned on, the micom (23) executes an operation according to the program stored in the ROM (not shown) with built-in instruction codes. The initial operation is to turn on the normal lamp of the luminescence (35) and indicate the time value received from the real time clock (not shown) to the LCD (34). At this time, the time value allows the error range of 1/100 sec., and is controllable using the mode selection switch (32). The expanded timer supported till 2100 year is used.

The backup power supply of said timer operates separately from the main power supply. The LCD (34) is a low power LCD capable of indicating 2 lines x 8 letters, and has a function of indicating not only the temperature/humidity measurement results detected through the no-power electric sensor (11), but also the

output state of the real time and each parameter.

The detected humidity value is read after specifying the mode to humidity using the mode selection switch (32) formed at the key input (22). The micom (23), like a conventional controller, comprises a ROM and RAM with built-in programs. The micom (23) compares the allowable base value of the ratio of the temperature to the humidity from the ROM to the measured humidity. If the measured humidity exceeds the allowable base value, the alarm is generated through the alarm generator (24) and the alarm display is indicated through the luminescence (35). The normal state is changed into the fault state if the detected humidity in the normal state exceeds the allowable base value. Therefore, the current state (humidity saturation or water permeation) of the closure being detected can be known.

In the same manner, the measured temperature value within the closure can be read by converting the mode selection switch (32) to the temperature sensor mode. Now, the user can set the proper temperature range, and the method is as follows:

selecting a set mode with pushing all of the selection switches for 5 seconds at the temperature measurement display;

adjusting the lowest allowable temperature and the highest allowable temperature in order by the up/down control key (33); and

indicating the temperature alarm display with an alarm if the sensing temperature exceeds the set temperature range, turning on the fault state lamp showing state where the temperature detection result at the closure is not within the proper

range.

On the other hand, each detected data of the temperature and the humidity using the mode selection switch (32) can be stored or deleted by the up/down control key (33). The values included in the temporary memory can be printed in a serial port manner by pushing a print selection switch (37). At this time, the measurement number, values for year/month/date/hour/minute, measurement order, measured humidity value and measured temperature value in order are outputted. A reset switch (36) which is not described here is to initialize the device when the water sensing meter (20) itself has a failure or faulty operation.

As described above, the optical cable closure maintenance system according to the present invention can recognize whether the inundation has occurred in the closure without opening the box, thereby preventing economic loss and waste of human resource due to the opening with respect to the components consumed for avoiding inundation.

Further, it is advantageous in that consistent maintenance can be done since the optical path section applying the optical cable closure maintenance system according to the present invention can be measured periodically, handling the information thereof, and these outputs obtained therefrom can be utilized as a main recoded information of the optical path section.

Additionally, it has the effect of preemptively preventing the damage loss caused by occurrence of an accident and failure at the optical cable connection point

due to a fault, deformation, damage or inundation of the closure.